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(Professor of Surgery, Medical College of Virginia.)

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J. B. M., æt. 33 years, was wounded Friday evening, May 9th, 1873, by a round pistol ball, which entered the body two and a half inches below and to the right of the umbilicus, and exactly in a line drawn from that point to the anterior superior spine of the ilium of the right side. The bullet was fired from a Colt's army revolver at a distance of ten paces. It passed obliquely through the skin and muscular tissue of the anterior abdominal wall, as far as the fascia transversalis, and was then carried between this structure and the transversalis muscle, in a horizontal direction, until it reached the linea alba. At this point it was deflected, and entering the peritoneal cavity, it went downwards, backwards, and to the left, and passed through the left iliac bone about an inch below the crest, and half way between the anterior and posterior superior spinous processes of that bone. Finally it lodged under the skin and adipose tissue of that region.

I saw the patient in twenty or thirty minutes after the wound was received. He was lying as he had fallen when shot, upon his back, with his limbs extended. His pulse was 80, and natural; skin warm, and the expression of his face good. There was nothing in his general condition to indicate a severe and dangerous wound. If there was shock of injury, it was too slight to be appreciable. He had some pain in his belly, but it was not very severe, and reminded him of the pain he had felt when a boy after eating too many green apples. This is the third case, by the way, of gun-shot wound of the abdomen where the patient has voluntarily made to me this comparison. To show the complete absence of shock in this case, I will mention that the wounded man asked me to help him to rise, insisting that

he could stand up, if it was necessary. No serum or blood escaped from the wound. I was satisfied from the manner in which he had been shot, from the position of the wounded man in relation to the direction of the bullet, and from the presence of the pain referred to, that the peritoneal cavity had been opened, and I did not probe the wound with my finger or an instrument. Two hours after he was shot he vomited some brandy that had been given him before my arrival, and the pain became more severe. At 10 P. M., or three hours after being wounded, he took three-fourths of a grain of morphia, and was placed upon a bed in a carriage and driven over a rough road two miles to a house, where he remained until he died. At half-past twelve o'clock, or six hours and a half after he received the wound, his pulse was 80, skin warm, face good, and spirits cheerful. At 1.30 P. M., a violent paroxysm of pain came on, and I gave him hypodermically half a grain of morphia, and in half an hour, as the pain did not diminish, the dose was repeated. A bladder of ice was applied to the abdomen, and quiet and abstinence from all food and drink enjoined.

9 A. M.—Has slept well; is quiet; nearly free from pain; pulse 90; is very hopeful of getting well. Was directed to take 30 drops of McMunn's elixir of opium every fourth hour; to have a little crushed ice and milk and water to drink; the ice poultice to be continued. This treatment was kept up for forty-eight hours, without apparent change in his condition. During Monday night, symptoms of traumatic peritonitis set in, and Tuesday, at 4 P. M., his pulse was 130; temperature 101°; belly hard and tender, but not tympanitic; his face was anxious; had great thirst and some tendency to hiccough. He was treated with opium, stimulants, milk, beef tea, &c., but the symptoms gradually grew worse until Wednesday night, when he died.

Autopsy, sixteen hours after death, showed the course of the bullet to be as above described. There was no wound or contusion of any of the abdominal viscera. The round ball had evidently glided between the bowels without cutting or bruising them. A small piece of cloth was lying upon the great omentum. No blood was found in the cavity. Flakes of lymph were seen in the folds of the peritoneum, and fully a quart of reddish serum escaped from the pelvic and abdominal cavities during the examination. Inflammation of the whole of the peritoneum existed, the visceral and parietal portions being alike involved. Evidence of inflammation along the track of the ball was not greater than in any other portion.

J. K., æt. about 30 years, was wounded, June 24th, by a conoidal pistol ball. In resisting a policeman, he fell upon his left side, and while in this position

was shot by the officer, who at the time was probably not more than three or four feet from him. The ball struck two inches above and to the right of the umbilicus, went obliquely through the abdominal wall for an inch and a half, when it entered the cavity; it then passed for two inches closely along the posterior surface of the anterior abdominal wall, tearing in its course the parietal portion of the peritoneum, and making its exit five inches below and to the left of the umbilicus. I saw the man, in consultation with Dr. Jackson, in about half an hour after he had been shot. He had been placed in bed and his clothing removed by the Doctor's direction. His temperature was natural, pulse good, and face excellent. He greeted me cheerfully as I entered the room, and I had some difficulty in convincing him that his wound was serious enough to require quiet and absolute rest. He was treated with opium, cold to the belly, &c. In forty-eight hours peritoneal inflammation set in, and in twenty-four hours after this he died.

Post-mortem examination, made four hours after death, revealed the wound as I have represented it. There was no visceral injury whatever. General peritoneal inflammation, with here and there flakes of lymph, and about three pints of red serum in the cavity.

I distinctly recall the cases of two soldiers who received during the late war gun-shot wounds of the abdomen without visceral injury, in whom there was no shock of injury, and no diminution of temperature. Both of these cases ended fatally from peritonitis. Post-mortems in both showed the absence of lesion of the viscera and the presence of the red serum. So completely absent was shock of injury in one of these cases, that the soldier assured me he did not know that he had been wounded until some time after he had been shot. I was misled in this case, from the general appearance of the wounded man, into thinking that the peritoneal cavity had not been opened, and into making a favorable prognosis in his case. Loss of notes a short time before the close of the war prevents me from giving an account of these cases in detail.

As Chief Surgeon for four years of a large and actively engaged army, I have probably seen and treated as many cases of gun-shot wounds of the abdomen as any surgeon of my day, and I do not remember one instance of penetrating wound of the abdomen with visceral injury, where there was not marked reduction in the force of the pulse, great and persistent diminution of temperature, and an expression of face indicative of serious injury;

and I venture to suggest, if these observations are confirmed by subsequent experience, that the presence or absence of *prolonged shock* in penetrating wounds of the abdomen will enable us to decide the presence or absence of visceral injury, as well as assist in accuracy of prognosis and treatment. The size, force and direction of the missile, position of the patient, and other collateral evidence, are not always sufficient to enable us to determine whether the viscera are injured or not. Probing the wound with the finger only to determine its extent and direction, and not with the view of operative interference, is bad surgery and should certainly be condemned.

Two of these cases occurred in private practice, and two happened to have been noticed in the hurry and confusion attending a battle. The four cases coming under the observation of one individual, and having their exact character shown by post-mortem examinations, prove that penetrating wounds of the abdomen without visceral injury are not rare, and by no means impossible, as Malgaigne has, I believe, asserted.

The same result in all—death. The same pathological appearances—peritoneal inflammation and large quantities of bloody, acrid serum in the abdominal cavity. I have no doubt that death was caused in all of these cases by septicæmia, produced by absorption of the bloody serum, and that these men would probably have recovered if this could have been prevented—if this fluid could have been drained off as fast as it was formed.

In cases of death after penetrating wounds of the belly, with or without visceral injury, where the patients have escaped the danger of shock and hemorrhage, we find the same post-mortem appearances that have been shown usually to follow Ovariotomy—the presence of acrid and bloody serum producing what has generally been termed traumatic peritonitis, but which in truth is septicæmia. In both instances we have severe mechanical injury done the peritoneum. In both we have the same tendencies to death—collapse or shock, hemorrhage, and septicæmia. In Ovariotomy, the injury to the serous membrane is generally much greater than that inflicted by a simple penetrating wound, but the change produced in the character of that membrane by the pressure of an ovarian tumor enables it to bear an amount of manipulation which it would never tolerate in its healthy state. But notwithstanding this, the cause of death is usually in consequence of injury done that structure. Spencer Wells says, in speaking of his tables of 500 cases of completed Ovariotomy: "The cause of death in the fatal cases may be seen at a glance to be chiefly peritonitis, or some form of pyæmic fever or blood-poisoning so often associated with peritonitis." In an article on

Ovariotomy by Dr. J. Marion Sims, republished in the Richmond and Louisville Medical Journal, February, 1873, it is very well shown, by the seven post-mortem examinations made by Dr. Sims, and the 26 post-mortems in the cases occurring in the practice of Mr. Wells, that the cause of death was due to the presence of pent-up colored acrid serum in the peritoneal cavity. The writer says that death may be due to shock, or exhaustion, or hemorrhage, or heart-clot, but these are of rare occurrence; and in 37 out of the 39 cases examined, death was "clearly traceable to the poisonous fluids effused in the peritoneal cavity." He proposes to prevent this collection by inserting a drainage tube through the Douglass cul-de-sac into the cavity of the peritoneum, and drain off the septic fluid as rapidly as it is formed. He has employed the drainage tube for this purpose in four cases, and ascribes the recovery of two of his patients to its use. I was convinced, after reading this paper, of the correctness of the author's views in regard to the necessity for drainage after Ovariotomy, and determined to use it in the next case I operated on. The following cases are reported as bearing upon this subject of drainage after wounds of the peritoneum, and not because they have any special interest as simple cases of Ovariotomy:

Miss S. W., æt. 48 years, single, from Prince Edward county, Va., has enjoyed good health until six years ago, when she noticed some enlargement of the abdomen, and some uneasiness and hardness in the right groin. Upon examination, a tumor about the size of a turkey egg was discovered. It increased very slowly, if at all, until February 15th, 1873, when it began to grow rapidly. Between the 15th of February and the 15th of April, the measurement around her abdomen at the umbilicus increased five inches. When the tumor began to grow, but before it had increased very much, she consulted the eminent surgeon, Dr. Mettauer, of this State, who advised against any surgical interference. She was so completely disabled by the tumor in May, that Dr. J. L. White, of Farmville, her family physician, sent her to me. She was much emaciated, her stomach and bowels in an exceedingly irritable state. The tumor was still growing, and her general health rapidly declining. Had never been tapped. She measured 45 inches around the largest part of the abdomen.

Diagnosis—Multilocular ovarian cyst of the right side.

May 27th.—Chloroform was administered by Dr. Taliaferro, and, assisted by Drs. Thomas, Upshur and Ross, of this city, and Drs. Dunn and Leigh, of Petersburg, I performed Ovariotomy. There was nothing unusual in the

operation. The large, thick-walled single cyst was attached to the anterior abdominal wall by adhesions which readily gave way, except at the upper and right portion, where they were so thick and strong that I was obliged to use the scissors and knife. There were no adhesions on its posterior surface. The pedicle was secured in a clamp, and the blood, amounting to one or two ounces, which had escaped from the torn and cut adhesions, carefully sponged from the cavity. The cyst weighed three pounds, and contained forty-three pints of fluid, a little darker but very much like healthy urine in appearance. Having determined to use the drainage tube suggested by Sims, I passed a large trocar through Douglass' cul-de-sac into the recto-vaginal pouch of the peritoneum. Withdrawing the stylet, a piece of gum-tubing which I supposed had been properly prepared, was carried through the canula. One end of this tube projected several inches beyond the vulva, and the other was carried through the pelvic and peritoneal cavity, and was intended to have been fastened at the lower angle of the abdominal incision, but I found the gentleman to whom I entrusted the preparation of the tube had misunderstood my intention in regard to it. He had punched holes in it throughout its entire length. Not having another tube at hand, I withdrew the one which had been inserted, and closed the wound in the ordinary way with silver sutures. A solution of per-sulphate of iron was applied to the stump of the pedicle, and cotton-batting laid on the belly and held down with a flannel roller. The operation lasted thirty-five minutes. She recovered slowly from the effects of the chloroform, and did not re-act well for several hours. In twenty-four hours the nausea from chloroform had passed off, and she was quiet and hopeful. Has slept some, has no pain, and takes with some relish champagne or butter-milk in very small quantities. At the end of the second day, or forty-eight hours after the operation, nausea and vomiting became almost incessant. She was anxious and restless; pulse 130; temperature 102°.

I left her that night, thinking she would die in twenty-four hours. The next morning I was surprised to find her much better; pulse 98; temperature 99°; nausea gone; spirits cheerful. I was entirely at a loss to account for the change, until on examining the wound, I found the folded sheet which had been placed under her hips saturated with bloody serum, which had escaped from the vagina through the opening made into the Douglass cul-de-sac. More than half a pint had been discharged in this way, and continued to escape for hours afterwards. Dr. Taliaferro, the physician at the Infirmary, who used the catheter for this patient, informed me that the dis-

charge was acrid and very offensive, and he found it necessary to use soap and water and disinfectants freely, to rid his hands of the odor left by the discharge. She told me afterwards that she knew exactly when the discharge took place. From that moment she began to improve. The clamp came off on the twelfth day. The wound closed and she was out of bed some time during the fourth week.

I am very well satisfied that this lady owes her life to the puncture made through the vagina into the peritoneal cavity and the drainage which took place through it. In a letter just received from her, she says she is in better health than she has been for years.

Mrs. M., æt. 45, wife of a prominent physician of this State, naturally of good constitution, robust, with obese tendency, weighing when well, 190 lbs. Has had eight children, the youngest now seventeen years old. About one year after the birth of the last child, she was supposed to be again pregnant, and at the end of nine months discharged a large hydatiform mole, the birth of which was attended with violent and protracted pain, and followed by profuse and almost fatal hemorrhage. Has had occasional attacks of pain and tenderness in the left ovarian region since that time. Seven months ago, she discovered a tumor there, which apparently remained stationary for two months, and then began to grow rapidly. During the last three months, has had repeated and violent attacks of pain in the abdomen, attended with fever. She measures around the abdomen at the umbilicus forty-seven inches, and from the ensiform cartilage to the pubis twenty inches. The uterus is central, slightly prolapsed and fixed; its cavity measures three and a quarter inches. She has nausea, occasional vomiting, dyspnœa, and attacks of faintness which are very alarming. The functions of nearly all of the abdominal organs are obstructed by the size of the tumor. The urine is scanty, loaded with lithates, and albumen frequently but not constantly present. No casts have been found in it.

I saw this patient for the first time August 5th, 1873; and a day or two afterwards, for the sake of temporary relief, tapped her, and succeeded, after much trouble, in drawing off about a gallon of dark reddish albuminous fluid. The more urgent symptoms were immediately relieved by this; her appetite returned, and she rapidly improved in strength. In fifteen days, however, the fluid re-accumulated, and the abdomen regained its former dimensions. As the weather was very warm, and her general condition still unfavorable, I would have repeated the tapping, in order to gain time, if I could have found a cyst large enough to afford relief by paracentesis. As I

could not discover this, and the symptoms were urgent, I decided to operate at once.

Diagnosis—Multilocular ovarian tumor.

Prognosis—Unfavorable.

August 30th.—Assisted by Professors McCaw, Cunningham and Wellford, and Drs. Thomas, Taliaferro and Skelton, I performed Ovariotomy. A mixture of chloroform, ether and alcohol was used as an anæsthetic. An incision five inches long was made between the umbilicus and pubis through the skin and a layer of fat more than two inches thick. The tumor had numerous attachments, principally parietal, many of them slight and easily broken down, but some of them strong, thick, fleshy bands, which were separated with difficulty. The pedicle was long and narrow, and twisted twice upon itself, showing that the tumor had undergone spontaneous rotation during some period of its course. Atlee's clamp was used to secure the pedicle, and the abdominal cavity thoroughly cleared of blood which had oozed from the torn adhesions. For the purposes of drainage, a large trocar was passed through the Douglass cul-de-sac into the peritoneal cavity. The abdominal wound was closed with deep and superficial silk sutures, the former including the peritoneum. The abdomen was padded with cotton-batting, a flannel bandage placed around it, and the patient removed to the bed. As soon as she recovered from the effects of the anæsthetic, one-third of a grain of morphia was administered hypodermically.

August 31st, 5 A. M.—Pulse 120; temperature 101°. Had several hours of refreshing sleep during the night. Complains of slight abdominal soreness. Catheter used, and one-fourth of a grain of morphia given. Asked for sweet milk, and has taken it in small quantities.

8 A. M.—Some nausea; vomited once for the first time since the operation. Iced champagne in teaspoonful doses given. No drainage.

9 A. M.—Pulse 120; temperature 102°; is quiet; nausea gone. Has taken one pint of milk in the last twenty-four hours. Napkin stained with red serous discharge from the vagina.

September 1st, A. M.—Slept the greater part of last night; pulse 104; temperature 100½°; the napkin showed slight colored discharge from the vagina. From this period no particular event occurred until September 10th, when the clamp came away. The pulse varied from 104 to 112, and the temperature from 99.5° to 102°. The patient was nourished almost exclusively with milk, and kept moderately under the influence of morphia. In consequence, doubtless, of the presence of the large quantity of adipose

tissue, free suppuration took place about all of the sutures. Around the deep sutures large collections of matter formed, and continued to be discharged for some days after the stitches were removed. The colored discharge from the vagina ceased about the fifth day, and was followed by a free discharge of pus, which lasted for three or four days and then gradually stopped.

September 11th.—Bowels moved for the first time since the operation. Complains of some pain in the rectum and irritable bladder. From this date she continued slowly to improve; the irritability of her bladder and rectum passed off; her appetite and strength gradually returned as the pulse and temperature diminished. She is now (Nov. 1st) well and going about.

Mrs. M. M., æt. 49 years, had one child 11 years ago; was admitted into the College Infirmary September 30th, 1873. About seven years since, she had a dull pain in the right iliac region, and soon afterwards noticed some increase in the size of the abdomen. At this time, she believed herself to be pregnant, and did not become convinced of the mistake until nine months had passed. Has suffered occasional attacks of pain in her back and lower part of the abdomen; but until a few months ago these attacks have not prevented her from attending to her ordinary duties. About two years after the pain and swelling commenced, her bladder began to trouble her; micturition became difficult and frequent. This has gradually increased, and is now the source of her greatest distress. She has a large cystocele protruding from the vulva, and is unable to empty the bladder unless she pushes the tumor back into the vagina and presses forcibly upon it with her fingers. Pain in the abdomen has lately become constant, sometimes excessive. She represents it as beginning in the right side and extending up as far as the shoulder. The recumbent posture increases the pain. She sleeps very little, and chiefly in a sitting position. Her appetite is tolerably good; pulse about 90; tongue clean and bowels regular.

The abdomen measures in circumference at the umbilicus 44½ inches; from ensiform cartilage to pubis 19 inches; from anterior superior spinous process of the right side to umbilicus 11½ inches; from anterior superior spinous process of left side to umbilicus 10½ inches. The uterus is movable, not displaced; cavity four inches long.

Diagnosis—Multilocular ovarian tumor of the right side.

Prognosis—Favorable.

October 2d, 1873.—Her bowels having been well emptied by a dose of castor oil administered the evening before, she was placed upon a table, and a mixture of chloroform, ether and alcohol given by Dr. Taliaferro. The following gentlemen were present and assisted in the operation: Professors Cunningham, Wellford and Manson, and Drs. Thomas, Ross, Watkins and Upshur.

After making an incision down to the cyst and separating some of its adhesions, which I accomplished with much difficulty (so intimately were they blended together), I removed by the trocar about three gallons of dark, porter-colored fluid, and then attempted to turn out the empty cyst. I found it, however, closely adherent to the abdominal walls and viscera. By a thin layer of organized lymph, the cyst wall was sealed to everything it touched. After much difficulty I succeeded in separating all of its adhesions, both parietal and visceral; and turning the tumor out, secured the pedicle, which was large and thick, in Atlee's new clamp. There was free oozing of blood from the torn adhesions, but it gradually ceased on exposing the parts to the air. No ligature was required. The cavity of the abdomen was thoroughly cleansed of blood, and for the purposes of drainage a trocar was carried, as in the preceding cases, from Douglass' cul-de-sac into the peritoneal pouch between the vagina and rectum. The abdominal wound was closed with deep and snperficial silk sutures.

She recovered slowly from the effects of the anæsthetic. When consciousness returned, she became restless and complained of great pain in the abdomen. She had nausea, with occasional attacks of vomiting, cold extremities, feeble pulse, and gradually sunk and died from exhaustion thirty hours after the operation.

As her friends were anxious to remove her body at once, a post-mortem examination could not be obtained; but Dr. Taliaferro, in removing the clamp, cut the sutures and exposed a portion of the abdominal cavity. There had been no hemorrhage.

I shall never again be willing to trust to drainage effected in this way after Ovariotomy. The openings made by the trocar are too small and too easily choked by a clot of blood, or obstructed by a fold of the vagina, or in some way closed and rendered unfit for drainage. I think it will be better, just before closing the abdominal incision, to make an opening with a sharp bistoury from Douglass' cul-de-sac into the peritoneal cavity, and touch the edges of this outlet with per-sulphate of iron to prevent immediate union of the cut surfaces. This opening should be shaped like a horse-shoe, and

large enough to admit the point of the finger. A double thread should be passed through the top of the flap, the convex portion of which should look towards the uterus, and the ends of the thread extend beyond the vulva. This would serve as a guide to the finger or an instrument if closure was threatened. The opening thus made would add nothing to the danger of Ovariotomy, and spontaneous union would take place soon after the thread was withdrawn. If for any reason a ligature instead of the clamp was used, the ends of the ligature could be brought through this opening into the vagina and out of the vulva.

The cases recorded show, as far as they go, that the peritoneo-vaginal outlet, if large enough, is sufficient to effect drainage, and there is no necessity for the drainage tube. Indeed, the same objection that applies to the ligature threads, when the pedicle is secured in that way, might be used with even greater force against the drainage tube. Wells says, "I think the ligature threads act as a sort of seton in the peritoneal cavity, set up inflammation, and excite the formation of the serum, for which they are said to provide the outlet."

The same author informs us: "Where bad symptoms follow ovariotomy, the surgeon should suspect that some fluid, either serum, blood or pus, is collecting in the peritoneal cavity. It may collect in such quantity as to give rise to sensible fluctuation from one side of the abdomen to the other." He advises the evacuation of this fluid as soon as it is detected, and his experience is "that the benefit of the evacuation of fluid is often very marked; and that any danger arises from too early closing of the opening, not from the opening having been made."

I can see no good reason why this outlet should not be made when the Ovariotomy is performed, as it adds, at the time, nothing to the danger of the operation. To defer it for a few days is to subject the patient to the hazard of septicæmia from a quantity of serum too small to be detected by fluctuation, or to incur the risk of being obliged to drain it after blood-poisoning has probably commenced, and when the patient is in no condition to bear additional surgical interference, however trifling.

Cannot drainage also be procured after gun-shot, and other penetrating wounds of the abdomen, with or without visceral injury; or shall we continue what Dr. Otis calls the "Ostrich plan," of giving opium and making the patient as comfortable as possible until death relieves him? Dr. Otis, who has had unusual opportunities, and who has investigated this subject with the same care and ability that has characterized all of his writings,

says, in Circular No. 3, Surgeon General's Reports, 1871, page 87: "The general mortality in these cases is so very large as to furnish additional argument in behalf of M. Legouest's proposition to incise the abdominal walls and explore the track of the projectile in certain gun-shot penetrating or perforating wounds of that cavity. Thus only can the patient exchange the probability of inevitable death for the possibility of recovery." He believes that prejudices against this operation, as at one time against Ovariotomy, will be dispelled before many years have elapsed. Of the truth of this statement I have no doubt; and when the abdominal wall is opened, the track of the bullet explored, internal hemorrhage arrested, or fæcal extravasation prevented, the chances of recovery will be still further increased by making a free outlet for the red serum, which traumatic peritonitis produces, and which kills by septicæmia. The bottom of the peritoneal cavity in woman is the recto-vaginal pouch. In man, the bottom of the cavity is the fold between the bladder and rectum. An outlet here into the rectum would drain the whole cavity, and could be made without any difficulty before the abdominal incision was closed.

If the wound is a perforating one, without visceral injury, and one of the openings can be made dependent, it should be kept open and drainage effected through it. If the wound is a simple penetrating one, without visceral injury or internal hemorrhage, and no abdominal incision necessary, under the influence of an anæsthetic, the fingers and half of the hand may be introduced into the rectum, as suggested and practised by Prof. Simon, the position of the bladder precisely determined, and the puncture made from the rectum into the cul-de-sac between that organ and the bladder, or the operation might be performed with a speculum analogous to that devised by Dr. Sims.

The suggestion made by Dr. Sims that gun-shot wounds of the pelvis are less fatal than similar injuries of the abdomen, will be confirmed by the experience of nearly every military surgeon. The diminished mortality in these cases is due, doubtless, to the drainage which the nature of the wound frequently permits.

Among my cases of stone, I have found two following gun-shot wounds of the pelvis. One of the calculi has as a nucleus a conoidal pistol ball; the other has in its centre a piece of bone torn from the os pubis and left by the bullet in the bladder.* Each case recovered from the gun-shot wound and the subsequent operation for stone.

*These calculi are in the "Army Medical Museum," Washington, D. C.